#18 appeal Brief 6/24/03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS AND PATENT INTERFERENCES

In re Patent Application of: **PAU ET AL.**	
Serial No. **09/390,554**	Examiner: **C. Parsons**
Filing Date: **September 3, 1999**	Art Unit: **2613**
For: **METHOD AND SCALABLE ARCHITECTURE FOR PARALLEL CALCULATION OF THE DCT OF BLOCKS OF PIXELS OF DIFFERENT SIZES AND COMPRESSION THROUGH FRACTAL CODING**	Attorney Docket No. **53137**

APPELLANTS' APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is Appellants' Appeal Brief (in triplicate) together with the requisite $320.00 fee for filing a brief. If any additional extension and/or fee is required, authorization is given to charge Deposit Account No. **01-0484**.

(1) REAL PARTY IN INTEREST

The real party in interest for the present application is the assignee, STMicroelectronics, S.r.l.

(2) RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences for the present application.

In re Patent Application of
PAU ET AL.
Serial No. **09/390,554**
Filed: **SEPTEMBER 3, 1999**

______________________________/

(3) STATUS OF CLAIMS

All of Claims 5-14 are pending in the present application and all are rejected. Accordingly, all of Claims 5-14 are the subject of this appeal.

(4) STATUS OF AMENDMENTS

An After Final Request for Reconsideration was filed March 13, 2003, and should be entered upon filing this appeal as indicated in the Advisory Action dated April 1, 2003. The claims were not amended in the After Final Response. The Appendix incorporates all prior amendments.

(5) CONCISE SUMMARY OF THE INVENTION

As perhaps best described on pages 27-30 of the specification with reference to FIG. 12 (reproduced below) and Figs. 13-24, the disclosed invention is directed to a method and a hardware architecture for calculating the discrete cosine transform (DCT) on a plurality of blocks of pixels, in parallel, and which provides for the scalability of the size of the blocks of pixels.

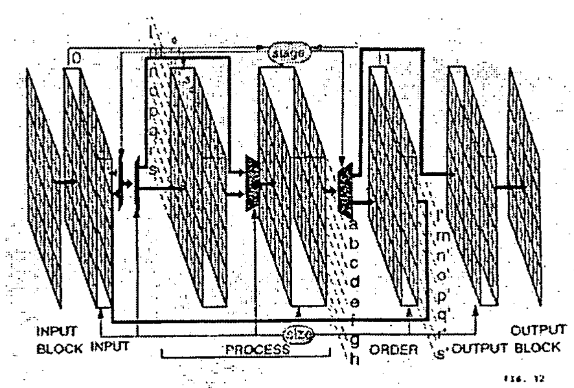

FIG. 12

The method of the present invention at least includes the use of scalable blocks of pixels of an image (e.g. page 27, lines 13-18), and the calculation, in parallel, of the DCT of scalable blocks of pixels of the image (e.g. page 28, lines 11-13). Similarly, the apparatus of the present invention at least includes a first defining unit/means to define first subdivision blocks as range blocks, having a fractional and scalable size, and a calculation unit/means to calculate, in parallel, the DCT of scalable blocks of pixels of the image (e.g. page 38, line 16 through page 39, line 2; Figs. 13 and 14).

(6) ISSUES

The issue presented on appeal is whether Claims 5-14 are patentable under 35 U.S.C. §103 over Zhao et al. ("A Hybrid Image Compression Scheme Combining Block-Based Fractal Coding and DCT" Signal Processing Image Communication, Vol. 8, No. 2, March 1, 1996, pp. 73-78) in view of Ericsson et al. (U.S. Patent No. 5,689,592).

(7) GROUPING OF CLAIMS

For the purposes of addressing the rejections under 35 U.S.C. §103: Claims 5-14 stand and fall together.

(8) ARGUMENT

Claims 5-12 were rejected in view of Zhao and Ericsson for the reasons set forth on pages 2-4 of the Final Office Action. Appellants contend that Claims 5-12 clearly define over the cited references, and in view of the following remarks, favorable

reconsideration of the rejection under 35 U.S.C. §103 is requested.

As described in the specification, the invention relates in general to digital processing systems for recording and/or transmitting pictures, and more in particular to systems for compressing and coding pictures by calculating the discrete cosine transform (DCT) of blocks of pixels of a picture. The invention is particularly useful in video coders according to the MPEG2 standard though it is applicable also to other systems. The calculation of the DCT of a pixel matrix of a picture is a fundamental step in processing picture data. Conventionally, the calculation of the discrete cosine transform is carried out on blocks or matrices of pixels, in which a whole picture is subdivided for processing purposes, e.g. as disclosed in the Background section of the present application or in the Zhao article. As in Zhao, the use of such a system and process imposes a pre-definition of the dimensions of the blocks of pixels into which a picture is subdivided to meet processing requisites.

However, on the contrary, and as discussed above, the disclosed invention is directed to a method and a hardware architecture for calculating the DCT on a plurality of blocks of pixels, <u>in parallel</u>, and which provides for the <u>scalability of the size</u> of the blocks of pixels.

Independent method Claims 5 and 8 at least include defining first subdivision blocks as range blocks, having a fractional and <u>scalable size $N/2^i * N/2^i$</u>, where i is an integer; and <u>calculating, in parallel</u>, the DCT of 2^i range blocks of a domain block. Similarly, independent apparatus Claims 9, 12 and 13 at least

include means/unit to define first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer; and means/unit to calculate in parallel, the DCT of 2^i range blocks of a domain block.

It is these combinations of features that are not fairly taught or suggested in the cited references and which patentably define over the cited references.

The Examiner has continued to rely on the Zhao article, cited by Appellant, as allegedly disclosing various features of the claimed method and apparatus. On page 3 of the Final Office Action, the Examiner asserts that Zhao teaches the use of fractional and scalable range blocks. However, in contrast, on page 2 of the Final Office Action, the Examiner's asserts that one of ordinary skill in the art could make the range blocks of Zhao scalable.

The Examiner's inconsistent characterization of the Zhao reference is puzzling. Both the Zhao reference and the present invention are directed to image compression based on fractal coding and discrete cosine transform (DCT) including the partitioning of the image into blocks. Thus, of course there is some commonality between the descriptions. For example, a schematic block diagram of a fractal-based image coding process is included in both the present specification (Fig. 1) and the Zhao article (Fig. 1). The implementation of the various blocks according to the present invention are further described and shown with reference to twenty-three additional drawings (Figs. 2-24) of the present application, which, of course, are not included in the allegedly "identical" Zhao article.

Indeed, Appellants have not simply disclosed and are not merely claiming the known approach of calculating a DCT for an image divided into range blocks and domain blocks, as discussed in Zhao. Appellants have disclosed and are claiming a method and a hardware architecture for calculating the DCT on a plurality of fractional and scalable range blocks of a domain block, which is nowhere discussed, taught or even considered in the Zhao paper. <u>There is no disclosure or teaching of any scalable DCT processing feature in Zhao</u>.

Moreover, Appellants are claiming the <u>parallel calculation of the DCT of such scalable range blocks</u>, which is also nowhere discussed, taught or considered in the Zhao paper.

The Ericsson patent describes the architecture of a logic processing unit of the Single Instruction Multiple Data type, which when included in a CPU may accelerate the execution via software of certain processing algorithms of signals. In the portion cited by the Examiner (Col. 3, lines 6-20), Ericsson merely recognizes the possibility of speeding up the processing of images by performing certain processing algorithms in parallel.

As discussed in previous responses, nothing in Ericsson et al. is suggestive of the method and relative architecture for parallel calculation of the DCT of scalable blocks of pixels of different size and compression characteristics as in the present invention. In other words, nothing in Ericsson et al. makes up for the deficiencies of the Zhao reference as discussed above.

As the Examiner and the Board are aware, to establish a prima facie case of obviousness, <u>the prior art references must teach or suggest all the claim features</u>.

There is simply no teaching or suggestion in the cited references to provide the combination of features as claimed. Accordingly, for at least the reasons given above, Appellants maintain that the cited references do not disclose or fairly suggest the invention as set forth in Claims 5, 8, 9, 12 and 13. Furthermore, no proper modification of the teachings of these references could result in the invention as claimed. Thus, the rejection under 35 U.S.C. §103(a) should be withdrawn.

It is submitted that the independent claims are patentable over the prior art. In view of the patentability of the independent claims, it is submitted that their dependent claims, which recite yet further distinguishing features are also patentable over the cited references for at least the reasons set forth above. Accordingly, these dependent claims require no further discussion herein.

CONCLUSION

In view of the substantive arguments presented above, it is submitted that all of the claims, namely Claims 5-14, are patentable over the prior art. Accordingly, Appellants respectfully request that all of the rejections be reversed.

Respectfully submitted,

PAUL J. DITMYER
Reg. No. 40,455
Allen, Dyer, Doppelt, Milbrath
& Gilchrist, P.A.
255 S. Orange Avenue, Suite 1401
Post Office Box 3791
Orlando, Florida 32802
407-841-2330
Attorney for Applicants

In re Patent Application of
PAU ET AL.
Serial No. **09/390,554**
Filed: **SEPTEMBER 3, 1999**
_______________________________/

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: A Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 16th day of June, 2003.

Dawn K. Kimler

In re Patent Application of
PAU ET AL.
Serial No. **09/390,554**
Filed: **SEPTEMBER 3, 1999**

APPENDIX INCLUDING THE CLAIMS ON APPEAL

FOR U.S. PATENT APPLICATION SERIAL NO. 09/390,554

5. A method of calculating the discrete cosine transform (DCT) of blocks of pixels of an image, comprising the steps of:

defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i * N/2^i$, where i is an integer;

defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels; and

calculating, in parallel, the DCT of 2^i range blocks of a domain block of $N*N$ pixels of the image.

6. A method according to Claim 5, wherein the step of calculating comprises the steps of:

a) ordering the pixels in the range blocks of a certain dimension by rearranging input pixels in 2^i vectors of 2^i components;

b) calculating, in parallel, 2^i monodimensional DCT*s* by processing the vectors defined in the step a);

c) arranging output sequences of the monodimensional DCT*s* relative to the 2^i vectors;

d) completing the calculation in parallel of 2^i bidimensional DCT*s* by processing output sequences of monodimensional DCT*s* produced in step c); and

e) arranging output sequences of bidimensional DCT*s* generated in step d) in 2^i vectors of bidimensional DCT coefficients.

7. A method according to Claim 6, wherein the step of calculating 2^i monodimensional DCT*s* in parallel in step b) and the step of completing the parallel calculation of 2^i bidimensional DCT*s* of step d) are performed by subdividing the sequences resulting from step a) and from step c), respectively, in groups of scalar elements, calculating the sums and differences thereof by way of adders and subtractors and by reiterately multiplying the sum and difference results by respective coefficients until completing the calculation of the relative DCT coefficients, respectively monodimensional and bidimensional.

8. A method of compressing data of an image to be stored or transmitted, comprising the steps of:

defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer;

defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

calculating, in parallel, the DCT of 2^i range blocks and of a relative domain block;

classifying the transformed range blocks according to their relative complexity represented by a sum of values of three AC coefficients;

applying a fractal transform in the DCT domain to data of the range blocks whose complexity classification exceeds a pre-defined threshold and only storing a DC coefficient of the range blocks with a complexity lower than the threshold, while identifying a relative domain block to which the range block in a

transformation belongs that produces a best fractal approximation of the range block;

calculating a difference between each range block and its fractal approximation;

quantizing the difference in the DCT domain by using a quantization table preestablished in consideration of human sight characteristics;

coding the quantized difference by a process based on probabilities of quantization coefficients; and

storing or transmitting code of each range block compressed in the DCT domain and the DC coefficient of each uncompressed range block.

9. An apparatus for calculating the discrete cosine transform (DCT) of blocks of pixels of an image, the apparatus comprising:

means for defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer;

means for defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels; and

means for calculating, in parallel, the DCT of 2^i range blocks of a domain block of $N*N$ pixels of the image.

10. An apparatus according to Claim 9, wherein the means for calculating comprises:

means for ordering the pixels in the range blocks of a certain dimension by rearranging input pixels in 2^i vectors of 2^i components;

means for calculating, in parallel, 2^i monodimensional DCT*s* by processing the vectors defined by the means for calculating;

means for arranging output sequences of the monodimensional DCT*s* relative to the 2^i vectors;

means for completing the calculation in parallel of 2^i bidimensional DCT*s* by processing output sequences of monodimensional DCT*s* produced by the means for arranging output sequences of the monodimensional DCT*s*; and

means for arranging output sequences of bidimensional DCT*s*, generated by the means for completing the calculation, in 2^i vectors of bidimensional DCT coefficients.

11. An apparatus according to Claim 10, wherein the means for calculating 2^i monodimensional DCT*s* in parallel in and the means for completing the parallel calculation of 2^i bidimensional DCT*s* are for subdividing the sequences resulting from the means for ordering and the means for arranging output sequences of the monodimensional DCT*s*, respectively, in groups of scalar elements, calculating the sums and differences thereof by way of adders and subtractors and by reiterately multiplying the sum and difference results by respective coefficients until completing the calculation of the relative DCT coefficients, respectively monodimensional and bidimensional.

In re Patent Application of
PAU ET AL.
Serial No. **09/390,554**
Filed: **SEPTEMBER 3, 1999**
______________________________/

12. An apparatus for compressing data of an image to be stored or transmitted, comprising:

means for defining first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i * N/2^i$, where i is an integer;

means for defining second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels;

means for calculating, in parallel, the DCT of 2^i range blocks and of a relative domain block;

means for classifying the transformed range blocks according to their relative complexity represented by a sum of values of three AC coefficients;

means for applying a fractal transform in the DCT domain to data of the range blocks whose complexity classification exceeds a pre-defined threshold and only storing a DC coefficient of the range blocks with a complexity lower than the threshold, while identifying a relative domain block to which the range block in a transformation belongs that produces a best fractal approximation of the range block;

means for calculating a difference between each range block and its fractal approximation;

means for quantizing the difference in the DCT domain by using a quantization table preestablished in consideration of human sight characteristics;

means for coding the quantized difference by a process based on probabilities of quantization coefficients; and

means for storing or transmitting code of each range block compressed in the DCT domain and the DC coefficient of each uncompressed range block.

In re Patent Application of
PAU ET AL.
Serial No. **09/390,554**
Filed: **SEPTEMBER 3, 1999**

13. An apparatus for calculating the discrete cosine transform (DCT) of blocks of pixels of an image, the apparatus comprising:

a first defining unit to define first subdivision blocks as range blocks, having a fractional and scalable size $N/2^i*N/2^i$, where i is an integer;

a second defining unit to define second subdivision blocks of $N*N$ pixels as domain blocks, shiftable by intervals of $N/2^i$ pixels; and

a calculation unit to calculate, in parallel, the DCT of 2^i range blocks of a domain block of $N*N$ pixels of the image.

14. An apparatus according to Claim 13, wherein the calculation unit comprises:

an ordering module to order the pixels in the range blocks of a certain dimension by rearranging input pixels in 2^i vectors of 2^i components;

a first calculating module to calculate, in parallel, 2^i monodimensional DCT*s* by processing vectors defined by the calculation unit;

a first output module to arrange output sequences of the monodimensional DCT*s* relative to the 2^i vectors;

a second calculating module to complete the calculation in parallel of 2^i bidimensional DCT*s* by processing output sequences of monodimensional DCT*s* produced by the output module; and

a second output module to arrange output sequences of bidimensional DCT*s*, generated by the second calculating module, in 2^i vectors of bidimensional DCT coefficients.